ANSWER KEY

PRESENTATION 1: **Imaging Acute Ischemic Stroke: The MGH Algorithm**

QUESTION 1	DISCUSSION RE: ANSWER OPTIONS
The following methods are Class I/Level A methods in the assessment of the acute ischemic stroke patient except: A. NIH stroke scale B. CTA C. Diffusion MRI D. CT perfusion	The correct answer is D: Theoretic considerations and the poor signal to noise ratio of the method makes CTP a Class IIb method and is unreliable for this purpose. A is incorrect because the neurological examination quantified using the NIH stroke scale is the single best predictor of patient outcome and is a Class I/Level A method for this purpose. B is incorrect because the stroke symptoms are produced by occlusion of an artery. CTA is highly reliable for the identification of arterial occlusions and is a Class I/Level A method for this purpose. C is incorrect because diffusion MRI is best method to identify early infarction and is a Class I/Level A method for this purpose.

QUESTION 2	DISCUSSION RE: ANSWER OPTIONS
The single most important parameter in predicting patient outcomes is: A. Neurological status (NIHSS) B. Site of occlusion C. Size of core D. Size of penumbra	The correct answer is A: All of the factors listed are predictive of patient outcomes, but the patient's neurological status as reflected by the NIH stroke scale has the strongest predictive value. B is incorrect because the site of occlusion is less predictive of outcome than the neurological status. C is incorrect the size of the core is less predictive of outcome than the neurological status and the site of occlusion. D is incorrect the size of the penumbra is the least effective method of all of those listed for predicting patient outcomes.

QUESTION 3	DISCUSSION RE: ANSWER OPTIONS
To treat a patient with an acute stroke syndrome that began less than 3 hours earlier in the standard fashion, the following imaging study is required: A. Non-contrast CT scan B. CT angiography C. CT perfusion D. No imaging is necessary; the history and neurological exam are sufficient	The correct answer is A: The standard treatment in the earliest stages of stroke is intravenously administered tissue plasminogen activator (tPA). In addition to knowledge of time of stroke onset, exclusion of hemorrhage by noncontrast CT is required. The presence of a large (>1/3 MCA territory) infarct identified on noncontrast CT images is also commonly used as an exclusion criteria. B is incorrect because CT angiography is a poor method for excluding hemorrhage. However, CTA is highly informative of the status of the cerebral arteries and is an excellent method to detect an acute occlusion that is causing the stroke syndrome. Thus, it is useful for diagnosis and management, but it is not required to determine with or not to use tPA. C is incorrect because CT perfusion is a poor method for excluding hemorrhage. CTP is highly reliable for the identification of hemodynamic abnormalities, but it is not required to determine whether or not to use tPA. D is incorrect because the history and neurological exam cannot exclude hemorrhage.

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ANSWER KEY

REFERENCES FOR QUESTIONS 1-3
Jauch, et al. Guidelines for the Early Management of Patients With Acute Ischemic Stroke. A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke. 2013; 44:870-947.
González RG et al. The Massachusetts General Hospital acute stroke imaging algorithm: an experience and evidence based approach. J Neurointerv Surg. 2013; 5 Suppl 1:i7-12.

PRESENTATION 2: **Collateral Circulation in Stroke**

QUESTION 4	DISCUSSION RE: ANSWER OPTIONS
Which mechanism is mostly responsible for the formation of cerebral collateral circulation: A. Angiogenesis B. Vasculogenesis C. Arteriogenesis	A. Angiogenesis refers to the formation of new blood vessels from pre-existing ones and is a mechanism primarily used by tumors. B. Vasculogenesis refers to the embryonic mechanisms by which blood vessels are formed; some very primary tumors that recapitulate embryogenesis show it. C. Arteriogenesis refers to the enlargement of pre-existing blood vessels by shear stress and distal ischemia *and is the correct answer*.

REFERENCE FOR QUESTION 4
Stroke. 2003; 34: 2279-2284

QUESTION 5	DISCUSSION RE: ANSWER OPTIONS
Poor cerebral collateral circulation results in: A. Adequate outcome after thrombolysis B. Adequate outcome after mechanical clot removal C. Increase risk of hemorrhage D. Does not have a bearing on prognosis	Correct answer is C Poor cerebral collateral circulation leads to poor outcome even after successful lysis or removal of intra-arterial thrombi. Futile recanalization is also more common in patients with poor collaterals. Patients with poor collaterals have an increased incidence of intracerebral hemorrhages with or without previous treatments.

REFERENCE FOR QUESTION 5
Bang OY, Saver JL, Kim SJ, Kim GM, Chung CS, Ovbiagele B, Lee KH, Liebeskind DS; UCLA-Samsung Stroke Collaborators. Collateral flow averts hemorrhagic transformation after endovascular therapy for acute ischemic stroke. Stroke. 2011 ;42(8):2235-9

QUESTION 6	DISCUSSION RE: ANSWER OPTIONS
Which infarctions zones are most likely salvageable? A. Core & penumbra B. Penumbra & border zone C. Border zone & core D. Oligemia & border zone	Correct answer is D. The least salvageable zone is the core and it is doubtful that the penumbra goes back to normal baseline after treatment. Only the distal border and oligemic zones probably return to normal function after treatment of infarction.

REFERENCE FOR QUESTIONS 6
Mangla R, Kolar B, Almast J, Ekholm SE. Border zone infarcts: pathophysiologic and imaging characteristics. Radiographics. 2011 ;31(5):1201-14